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Cancer Surveillance and Outreach in Carlisle, Massachusetts: An Analysis of MDPH Cancer and Environmental Health Data in a Small Town Context

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An Analysis of MDPH Cancer and Environmental Health Data in a Small Town Context

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Introduction and Background

- The National Cancer Institute estimates approximately 40.8 percent of men and women will be diagnosed with cancer at some point in their lifetime.
- The project's primary goal was a comprehensive review of cancer in Carlisle with recommendations for Carlisle's Board of Health (BOH).
- Carlisle is northwest of Boston, with population of 5,000.
- Median household income is \$160,000.
- 97.3% of Carlisle residents have health insurance coverage.
- 99.7% of residents have a high school diploma and 81.7% have a Bachelor's degree or higher.
- Compared to state averages, Carlisle residents (in CHNA 15) are:
 - Less likely to report poor access to health care (3.9% vs. 6.7%)
 - Less likely to report current smoking (10.1% vs. 15.8%)
 - Less likely to report overweight (51% vs. 58.2%)
 - More likely to report leisure time physical activity (86.6% vs. 78.7%)
- 67.4% of residents reported colonoscopy in past five years (63.5% statewide)
- 89% of Carlisle women had mammograms in past two years (84.5% statewide)

Methods

- Examined MDPH cancer surveillance data for Carlisle.
- Conducted literature review using PUBMED to discern relevant risk & protective factors.
- Evaluated potential impact of demographic and environmental factors on cancer incidence in Carlisle.
- Worked onsite with the BOH and at a town event to identify and address residents' cancer concerns.
- Explored cancer clusters and how investigations of environmental exposures are conducted.
- Solicited residents' feedback regarding preliminary results.
- Translated results into preventive and policy recommendations for BOH.
- Summarized individual & behavioral recommendations for Carlisle residents.

Data Sources

Massachusetts Cancer Registry

- Primary data source: Massachusetts Cancer Registry (MCR) city-and-town reports, including data on 23 different types of cancer over five-year intervals.
- Expected cases calculated using town population distribution and statewide age-specific incidence rates for 18 different age groups.
- Expected & observed cases are compared for all 351 municipalities in MA.

Environmental Health Data

- Examined MA Environmental Public Health Tracking (MA EPHT) data showing cancer by census tract, possible environmental exposures, and public water sources.
- Used Massachusetts Department of Environmental Protection (MassDEP) data and maps to examine the risk of exceeding arsenic limits in Carlisle drinking water.

Health Behavior Data

- Examined Behavioral Risk Factor Surveillance System (BRFSS) surveys on health behaviors in Carlisle.
- BRFSS data organized by Community Health Network Area (CHNA) was used to isolate & compare regional health behaviors.
- Explored Youth Risk Behavior Survey (YRBS) conducted by Concord-Carlisle School District to identify youth smoking rates.

Central Questions

- How does one interpret cancer surveillance data in a small town, when sample size is limited and statistical significance cannot be inferred?**
- When incidence is not statistically significant, what actions are recommended for cancer outreach, prevention efforts, and education?**

Carlisle Resident Concerns

- Arsenic in drinking water:** residents worried about possible presence of arsenic in private wells.
- Household radon:** particular concern about radon in homes.
- Testicular cancer:** recent cases in two young adults in Carlisle caused much discussion in town. Cases not yet visible in most recent MCR report.
- Cancer clusters:** none identified, but testicular cancer cases increased concern about clusters and cancer in general. Carlisle is a very engaged community and local cancer cases are noted.

Results

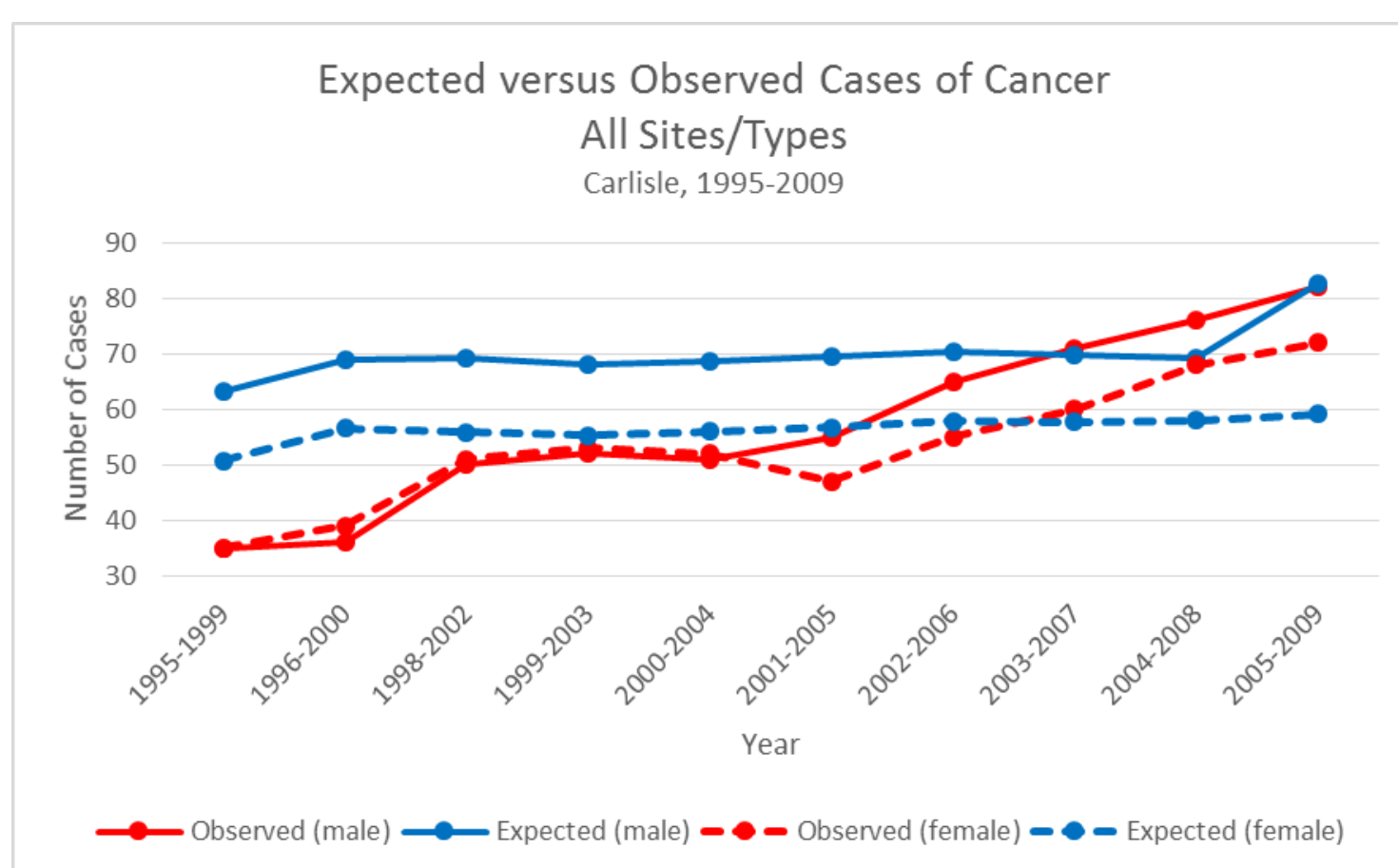
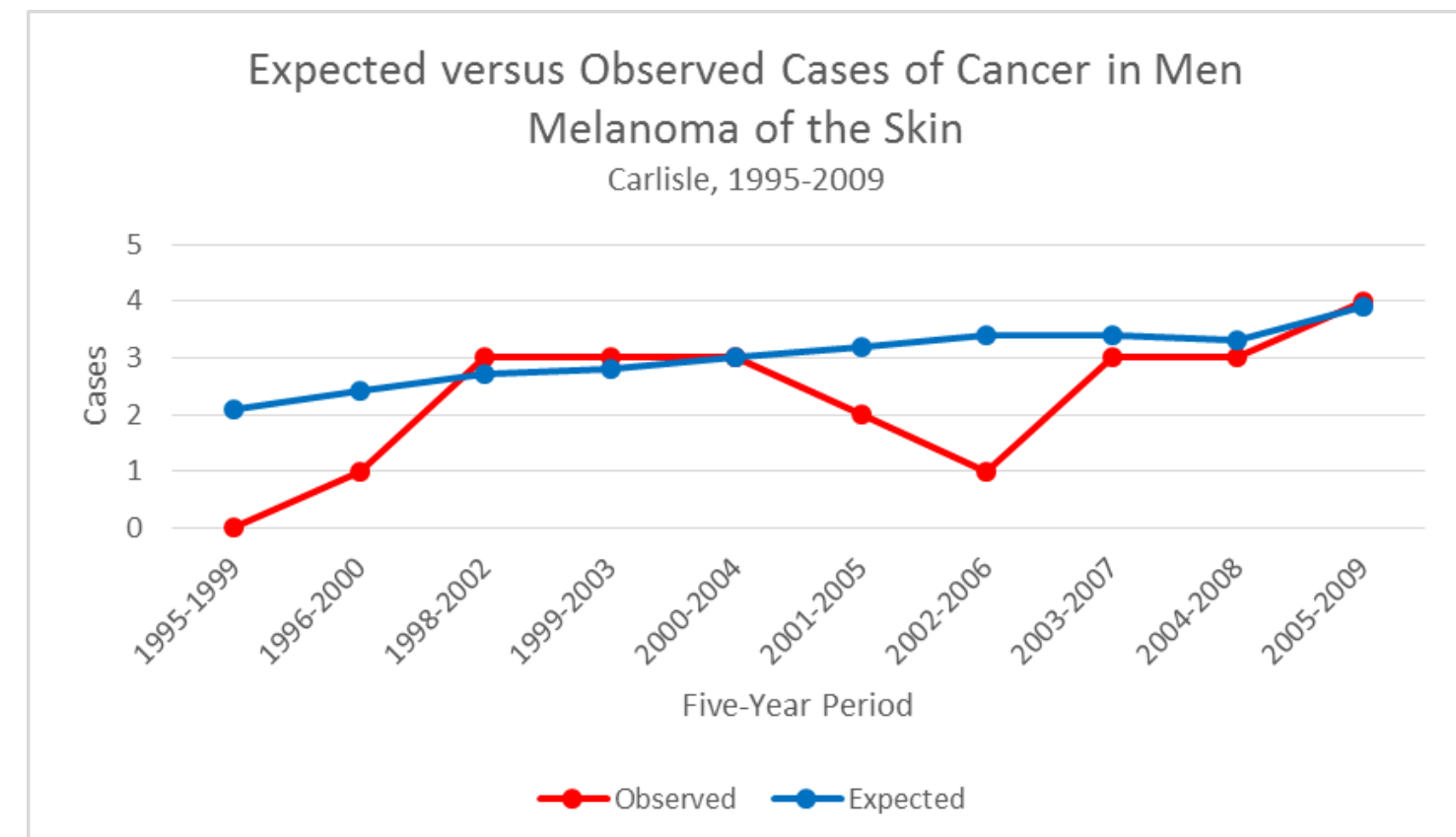
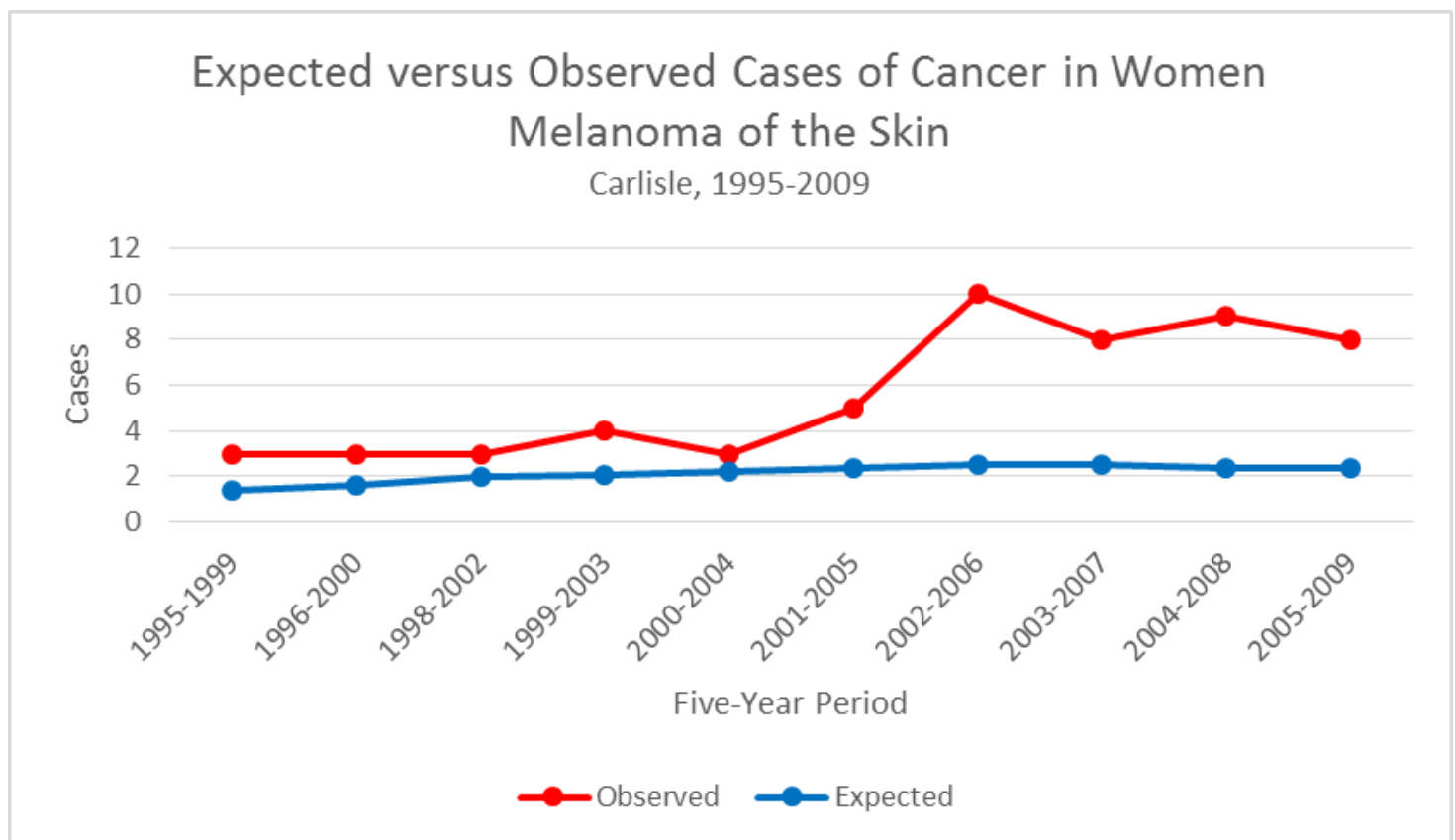


Figure 1: All cancers in Carlisle, 1995-2009. For both men and women, expected number of cases remained consistent over time, while observed cases increased over the same period.

Type of Cancer	Observed Cases	Expected Cases
Females		
Breast	25	19.3
Melanoma of the skin*	8	2.4
Thyroid	6	3.5
Colon/Rectum	5	4.4
Lung/Bronchus	4	7.8
Males		
Prostate	33	25.4
Colon/Rectum	9	7.1
Non-Hodgkin Lymphoma	5	3.3
Thyroid	4	1.3
Bladder/Urinary	3	5.7
Lung/Bronchus	3	11.2

*Indicates statistical significance More Cases than Expected Fewer Cases than Expected

Figure 2: Significant cancers in Carlisle from 2005-2009 MCR city-and-town report. Breast cancer & melanoma are the most significant cancers in women, and prostate & colorectal cancer are the most significant in men.



Figures 3 & 4: Melanoma in Carlisle men and women, 1995-2009. Observed melanoma cases in women greatly exceed expected cases. For men, observed and expected cases do not differ significantly over time.

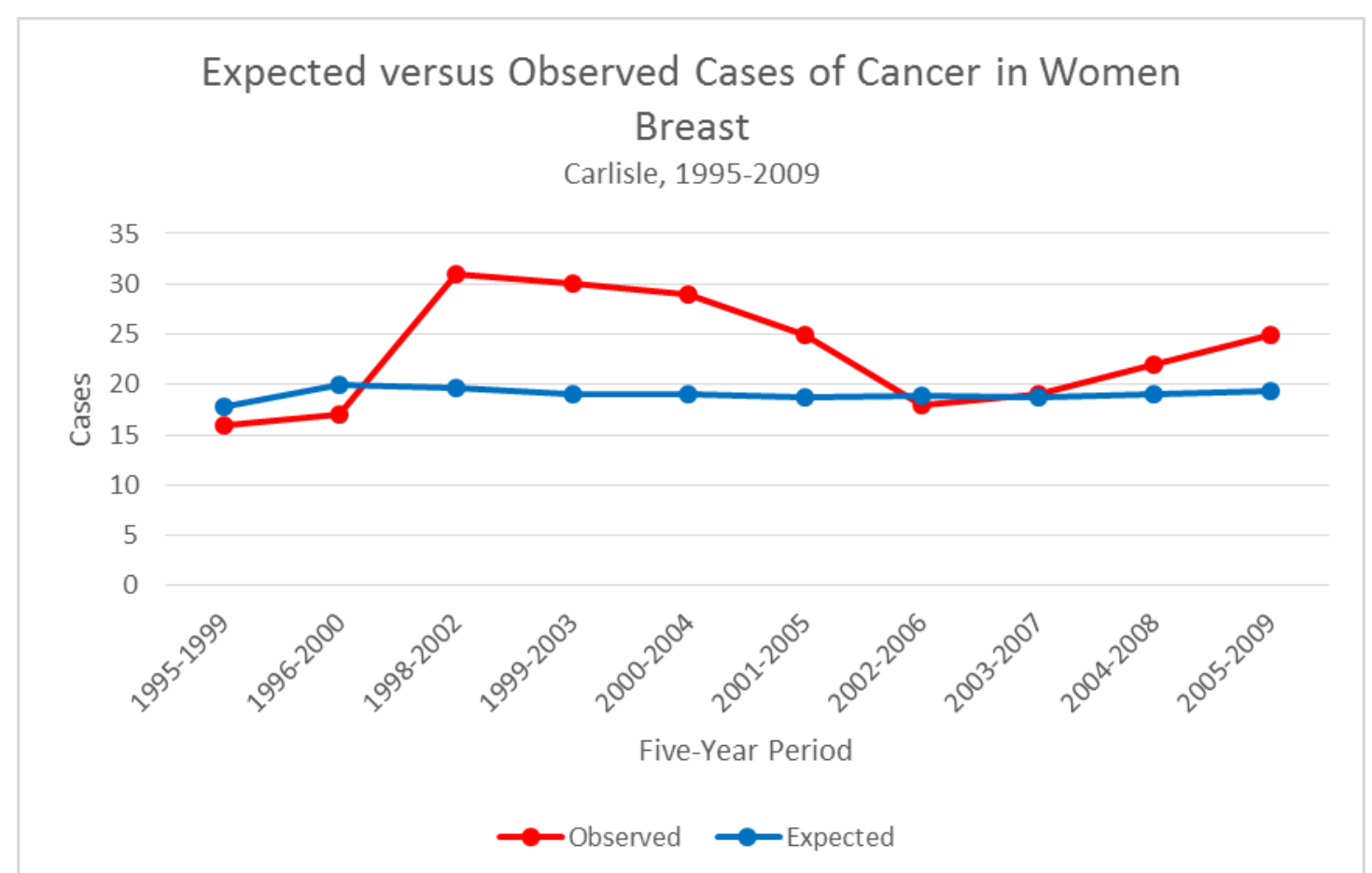


Figure 5: Breast cancer in Carlisle, 1995-2009. Expected number of cases has remained similar over time, while observed cases tended to exceed the expected cases.

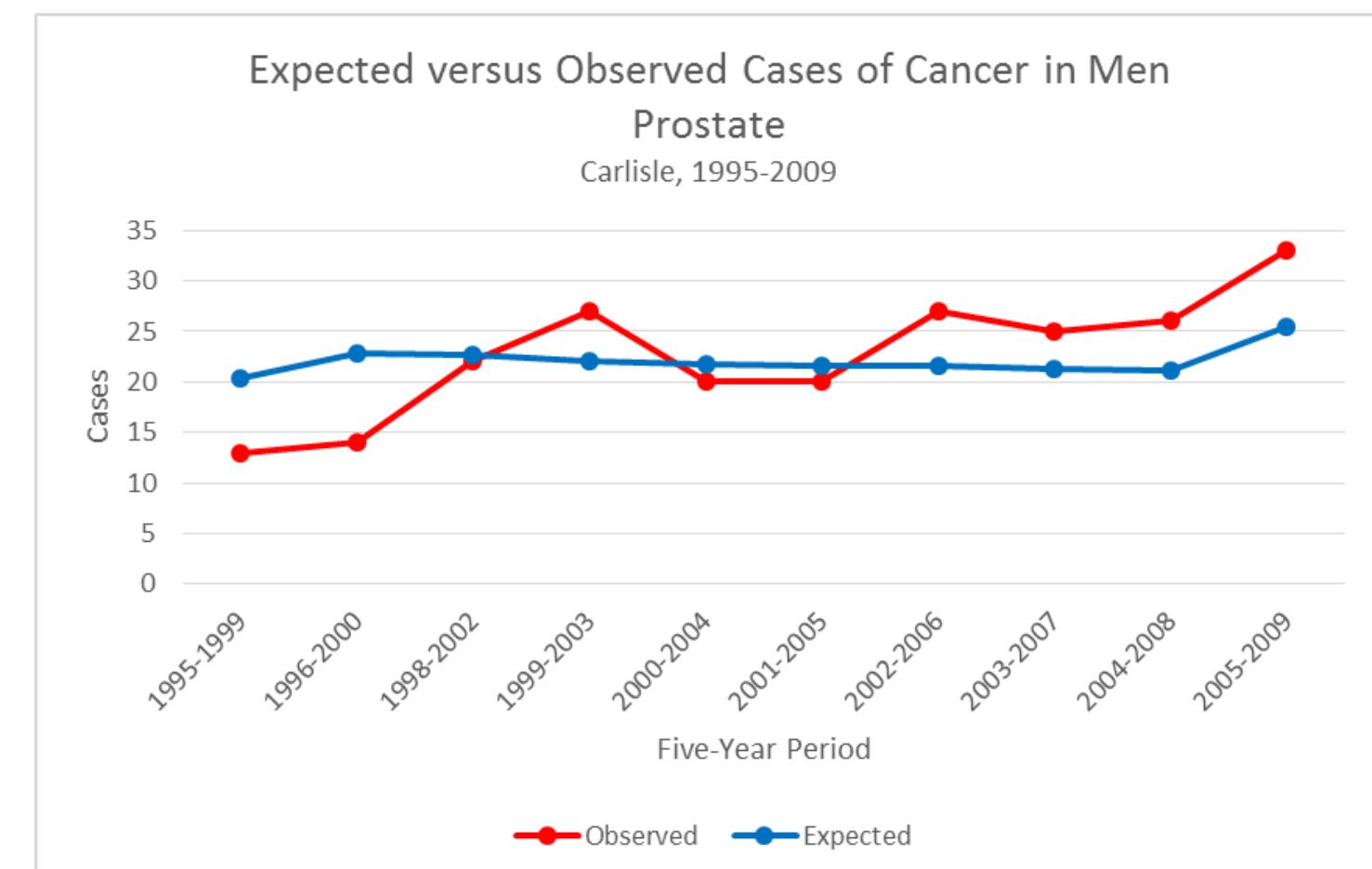


Figure 6: Prostate cancer in Carlisle, 1995-2009. Expected number of cases has trended slightly downward, while observed cases generally increased.

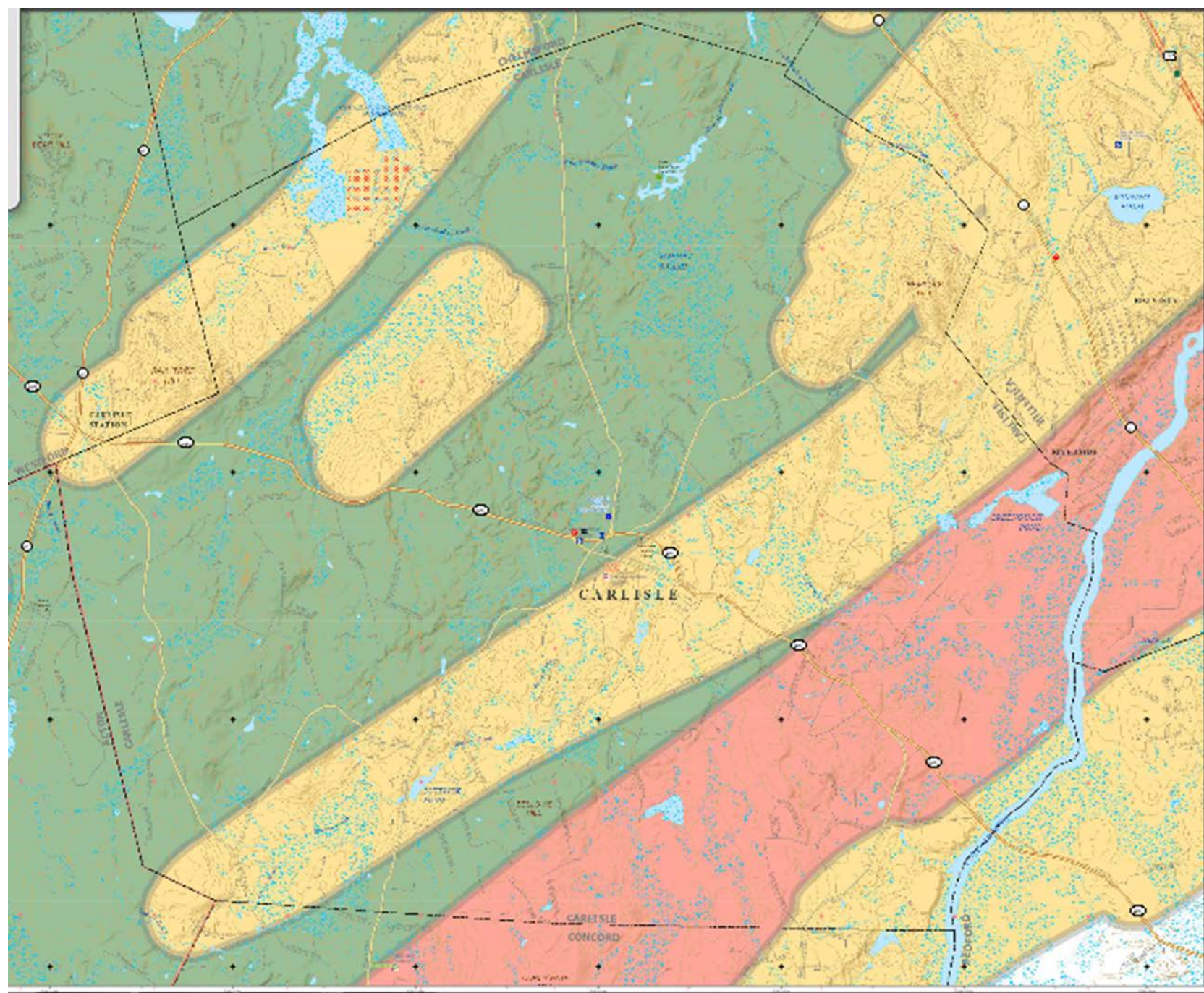


Figure 7: Bedrock Water Quality Map provided for Carlisle, March 2011 (Massachusetts Department of Environmental Protection (MassDEP)). This map shows the probability of exceeding MassDEP drinking water standards for arsenic (10 ppb). A substantial portion of town has high (10 - 25%) probability of exceeding the limit. Map available at: <http://www.mass.gov/eea/docs/dep/water/drinking/au/maps/carlisle-a.pdf>.

Discussion

- Expected cancer cases for men and women are very low for many cancers. As a result, small changes in observed cases have a large statistical impact.**
- Since expected & observed cases of all types of cancer are similar, increasing overall incidence of cancer may just be alignment with expected rates.
- The sole cancer with a statistically significant difference between observed and expected cases was **melanoma in women**. Observed melanoma cases in men are similar to expected numbers.
- The primary risk factor for melanoma is UV exposure. Some studies suggest that UV exposure is associated with socioeconomic status (SES). High rates of leisure time physical activity and high SES level in Carlisle could play a role in elevated melanoma rate.
- Breast cancer and prostate cancer** cases exceed the number expected, but neither was statistically significant. High rates of cancer screening and high levels of SES may contribute to the slightly elevated total of observed cases.
- Survival for breast and prostate cancer has also been linked to SES. Diagnosis for both cancers is often delayed in low-income patients.
- Incidence of **lung and bladder cancer** is lower than expected for men and women in Carlisle.
- A primary risk factor for both lung and bladder cancer is smoking. Low smoking rates in town likely account for the low incidence of lung and bladder cancer. YRBS data also indicates that smoking rates are declining among Concord-Carlisle high school students.
- The potential presence of **arsenic in Carlisle drinking water** should be noted. High-level arsenic exposure is linked to lung, bladder, and non-melanoma skin cancer; MassDEP's 10 ppb limit is classified as low exposure.
- The low incidence of lung and bladder cancer suggests arsenic exposure is not contributing to cancer incidence at this time.
- In the absence of statistical significance for many cancers in Carlisle, outreach should focus on modifiable risk factors and preventable cancers.**

Conclusion

Recommendations

- Advocate awareness of cancer risk factors, including family history and modifiable risk factors like smoking and UV exposure.
- The BOH should monitor MCR and MassDEP data for changes in cancer incidence or exposure. Testicular cancer incidence can be assessed in future data sets.
- Findings can be communicated via the local newspaper and at town events. Use of social media would enhance outreach efforts.
- BOH can advocate testing for arsenic in water & radon.
- Smoking prevention and cessation programs, including youth anti-tobacco programs, should continue.
- Sun protection programs and coordination with the town recreation department should be encouraged.

Limitations

- Carlisle's population and small sample sizes in incidence data prevent definitive inferences and conclusions.
- The town's one census tract and private wells preclude environmental and neighborhood-level cancer data assessment.
- Cancer is a complex disease with long lead times, making it difficult to find definitive causal relationships for many different cancers.

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